JPRS 75217

28 February 1980

USSR Report

SPACE

No. 3

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service (NTIS), Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semimonthly by the NTIS, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Indexes to this report (by keyword, author, personal names, title and series) are available through Bell & Howell, Old Mansfield Road, Wooster, Ohio, 44691.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

30272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. JPRS 75217	2.	3. Recipient's Accession No.
4. Title and Subtitle USSR REPORT: SPACE, No. 3			5. Report Date 28 February 1980 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address As above			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This report contains abstracts of formal scientific reports and news items on Soviet space exploration, including all aspects of the manned space program, space sciences, interplanetary research, space engineering, space research applications (communications, satellite geodesy, space meteorology, remote sensing) and space policy and administration.

17. Document Analysis a. Descriptors

USSR
Space Exploration
Space Technology

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group 03, 22, 17A, 17B, 17C, 17E, 17G, 17H, 17I

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Unlimited Availability Sold by NTIS Springfield, Virginia 22161	UNCLASSIFIED	47
	20. Security Class (This Page) UNCLASSIFIED	22. Price

(See ANSI-Z39.18)

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

JPRS 75217

28 February 1980

USSR REPORT

SPACE

No. 3

CONTENTS PAGE

I. MANNED MISSION HIGHLIGHTS

PETROV COMMENT ON FURTHER USE OF SALYUT-6

Moscow PRAVDA in Russian 31 Dec 79 p 3

[Article by V. Gubarev: "Space, on 31 December"]

[Excerpt] Will there be new launches?

"The station is in good condition," said HSU Professor Boris Petrov in answer to my question. "But, of course, Salyut-6 has already functioned in orbit for 2-1/2 years. Right now we are using the station in conjunction with tests of Soyuz-T, and we are carefully checking all of its systems and equipment... There will undoubtedly be new launches--to stop the development of cosmonautics would be impossible. Whether it will be this station that is further exploited, only the near future will tell."
[155-P]

CSO: 1866

IMPROVED SOYUZ-T CONTROL SYSTEM DESCRIBED

[Article by B. Kuznetsov: "Get acquainted: Soyuz-T"]

Moscow GUDOK in Russian 21 Dec 79 p 4

[Editorial report] The Moscow trade newspaper for the railroad transportation industry GUDOK has published a brief feature article on the Soyuz-T test vehicle which includes new information on the craft's modified flight control system. This system, which has been designated "Chayka" (seagull), features an on-board digital computer complex (BTSVK) based on integrated circuits. It also incorporates a display screen located in the craft's cabin so that the crew can visually monitor various flight operations. The computer system, which relieves the crew of the necessity of conducting manual operations, will control orientation, programmed turns, approach and docking, main engine firing and descent operations. All information provided by the on-board computer will also be received in real time by mission controllers at the Flight Control Center near Moscow.
[156-P]

CSO: 1866

SOYUZ-T MAY NOT TRANSPORT NEXT COSMONAUT CREW

Moscow World Service in English 1000 GMT 8 Jan 80

[Talk by (Ryma Karleyeva) at the Flight Control Center]

[Excerpt] Soyuz-T embodies many recent scientific and technological advances but this does not mean that the next manned flight will necessarily be made in these new craft. The previous Soyuz spacecraft--there have been more than 30 of them--acquitted [as received] themselves very well and they will continue to be used to carry cosmonauts into orbit in the immediate future. As for the present trial flight, it is a dress rehearsal with the spacecraft embodying many novel technical features.
[154-P]

CSO: 1866

SOYUZ-T TESTED FOR SURVIVABILITY AT SEA

SOYUZ-T Sea Trials Described

Moscow KRASNAYA ZVEZDA in Russian 8 Jan 80 p 4

[Article by Major Yu. Soldatenko: "The Salty Miles of Space"]

[Summary] The article reports on trials of the new modified SOYUZ-T manned transport ship to test its ability to remain afloat and to support cosmonaut operations in the event of a splashdown. The test group, which was based on an oceanographic research vessel, included project engineers of various design bureaus and scientific research institutes, instructors from the Gagarin Cosmonaut Training Center, medical personnel and specialists in the search-and-recovery service; A. Nuzhdin is identified as the deputy technical director of the test operations.

The sea trials involved testing the landing module's stability in a stormy sea with 3-point waves; water temperature during the tests was plus 3 degrees.

In one of the trials, test subjects (one of which was identified as "flight engineer" A. Tkach) inside the module were asked to determine the optimum procedures for removing their space suits and putting on thermal protective suits to protect them from the cold. In another test, which was directed by an engineer from the Cosmonaut Training Center and in which the author of this article participated, all life support systems were shut off in order to determine how long a crew could remain safely inside the cabin. Reporting on their physical condition every 15 minutes, the test subjects were able to remain inside with all systems down for twice as long as the period rated by SOYUZ-T designers.

The author notes that throughout the sea trials neither the landing module's instrumentation nor its life support systems failed to function properly.

Hungarian Press Reports on SOYUZ-T Sea Trials

Budapest MAGYAR HIRLAP in Hungarian 9 Jan 80 p 4

[Article by Jozsef Meruk: "Joint Flight of SALYUT-6 and SOYUZ-T, Perfecting Techniques for Water Landing"]

[Text] The return module of the SOYUZ-T spacecraft was subjected to a multitude of tests before launching. Among these were practice tests for landing over water, which covers 70% of the earth's surface. As the Moscow military journal KRASNAYA ZVEZDA reports, the return module, which is fitted with new types of equipment and instrumentation, withstood the demanding

tests. Instruments and cosmonaut life support systems were undamaged by wind, waves and other natural hazards. Special training of cosmonauts remains of primary importance despite the most perfect technology. Therefore, all cosmonauts undergo thorough training in splashdown procedures.

Splashdown equipment as well as the food and clothing required for survival until the arrival of the search-and-rescue team are as important as the other innovations, such as the on-board computer of the SOYUZ-T experimental transport ship. It is inconceivable that the Soviet search-and-rescue service would now be completely revamped for splashdowns, but it is worth noting that the SOYUZ-T was tested for "water landings" in advance. [200-P]

CSO: 1866

COSMONAUT OPERATIONS WITH KRT-10 RADIO TELESCOPE DESCRIBED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 1, 1980 pp 40-41

[Article by Engineer V. Krasnov: "The 'Progress' Has Delivered a Radio Telescope"]

[Excerpt] The delivery of the KRT-10 radio telescope into orbit, its deployment and operation constitute an important step in the development of investigations of the universe, and it is not without reason that this has caused broad scientific interest.

The space-borne radio telescope created by Soviet specialists is a unique instrument with a 10-m dish. It is designed to investigate astronomical radio sources as well as to map the earth's surface and ocean expanses. The telescope consists of a deployable parabolic antenna, hermetically sealed focal container with receivers, high-frequency instrumentation and a thermal regulation system, a support and separation mechanism, by means of which the antenna is affixed to the inner hatch of the station's transfer compartment and is separated from it after completion of the experimental program. In addition to these units, which are situated on the outside of the station, the KRT-10 includes a unit for shaping precise time signals, a control panel and data recording instrumentation. All this is placed in the work compartment of the station. The total mass of the KRT-10 exceeds 200 kg.

The complexity of the radio telescope and installation-assembly work aboard the station required that much attention be given to the training of the cosmonauts. Specialists foresaw the difficulties which the crew would encounter in the transfer of the large units of the KRT-10 to the station and their installation. It is enough to mention that the antenna reflector in a folded state has a length of more than a meter and a mass greater than 100 kg. Accordingly, cosmonaut training included the working through of all operations. First these training sessions were carried out in a ground model of the station with a lesser weight design-technological model of the radio telescope, and then in a hydrobasin.

Simultaneously, in specialized simulators, the cosmonauts learned to execute station astroorientation operations, point the radio telescope at the radiation sources and make measurements.

The cosmonauts on the orbital station had to make observations synchronously with a ground-based radio telescope installed in the Crimea. This was an important feature of the experiment with the KRT-10. The crew required additional instruction. Lessons in the fields of radioastronomy and astrophysics were carried out at the Crimean Astrophysical Observatory with the 22-m radio telescope. Here the crew practiced a method for making synchronous observations of pulsars and other radio sources, the skills required for radioastronomical measurements.

After completing the investigations in orbit the cosmonauts had to separate the antenna reflector together with the focal container and the support mechanism in order to free the station's equipment bay where the propulsion system and the second docking unit are located. This relatively simple operation is carried out using an automatic system. Accordingly, the crew was trained only in the installation of the cable withdrawal mechanism in the station's transfer chamber. Of course, at that time the cosmonauts did not know that unforeseen and more complex operations to separate the antenna were awaiting them.

During flight preparations V. Lyakhov and V. Ryumin visited enterprises and institutes of the USSR Academy of Sciences engaged in the development and production of the radio telescope in order to gain a more detailed familiarization with the KRT-10 and the problems related to its creation. This had good results--while testing the radio telescope the cosmonauts made a number of proposals for improving its design and carrying out the experiments.

The improvement of individual components of the radio telescope and methods for carrying out the assembly work continued even after the crew was already aboard the station. In order to familiarize the cosmonauts with these changes and in order to remind them of the most complex stages in assembling the KRT-10, the specialists at the Yu. A. Gagarin Cosmonaut Training Center prepared an instructional videofilm and five months later sent it, together with the radio telescope, on the "Progress-7."

Because it was impossible to transport the KRT-10 in assembled form, it was broken down into units and was put into orbit in that way. After the "Progress-7" had docked with the "Salyut-6," the cosmonauts moved the units into the work compartment of the station and after consulting with the specialists at the Flight Control Center proceeded to the installation-assembly work. First they placed the electronics units and the control panel in the work compartment. They connected these to the cable network and to the data recording system. Then they mounted the antenna support and separation mechanism on the inner hatch of the transfer chamber. Then they mounted the focal container and emitters and the folded five-meter antenna supports and connected the antenna reflector.

When convinced that everything had been done correctly, the cosmonauts checked the possibility for manual movement of the focal container and antenna reflector in the telescope support and separation mechanism. Upon completion of this operation they proceeded to the work compartment and closed the hatch into the transfer chamber.

On 18 July, after completing work with the "Progress-7 freighter," V. Lyakhov and V. Ryumin proceeded to the most critical stage--moving the telescope out into a working position (after undocking of the freighter) and

opening up its dish and the focal container supports. These operations were monitored by the crew and specialists at the Flight Control Center, first using the television camera on the freighter and then the television cameras of the station itself.

Thus, on that day, for the first time in history, an exoatmospheric orbital radioastronomical observation point was established in near-earth orbit.

On 19, 20 and 21 July the cosmonauts carried out adjustment operations and determined the antenna directional diagrams. This made it possible to find the true position of the antenna axes relative to the station's structural axes. The work was carried out using the powerful and well-studied discrete radio source Cassiopeia-A, which is also frequently used for these purposes on the earth.

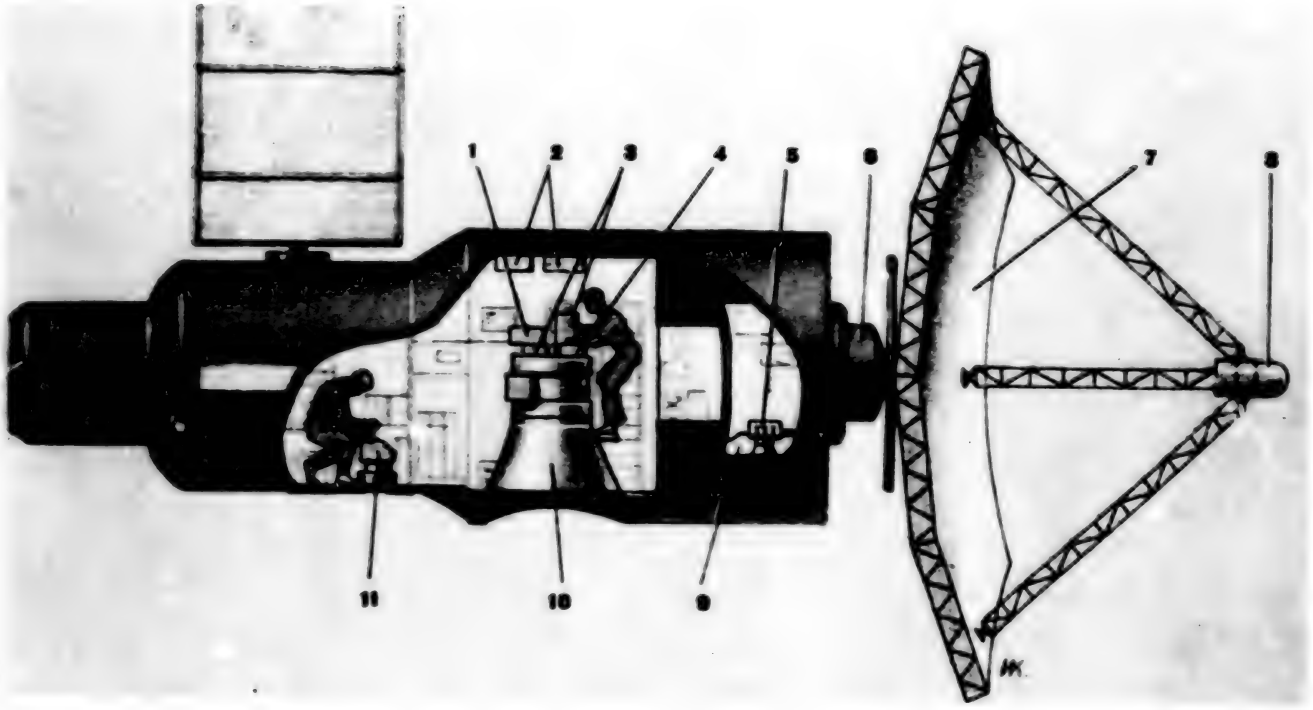
The astrophysical investigations included measuring the radio emissions of the sun and Cassiopeia-A, observing one of the powerful pulsars P0329, as well as scanning some radio sources in the Milky Way. The crew had to demonstrate particular coolness, coordination of actions and a clear-cut division of labor and responsibilities.

The crew commander, using the astroorientation instrument, carried out the stipulated orientation, then the pointing of the station, and consequently the orientation of the radio telescope antenna on the investigated object. At this time the ship's engineer was engaged in preparatory operations (switching on the radiometers, calibration of channels), measurements and recording the incoming information.

A new scientific result of this experiment was the execution of synchronous observations of space radio sources using radio telescopes separated by great distances and the creation of a system consisting of the KRT-10 on the "Salyut-6" and the ground-based 70-m radio telescope in the Crimea. The distance between them during the experiment exceeded 10,000 km. As a result, the system had high resolution, and new information was obtained on the structure of signals arriving from the depths of the universe, in particular, on the parameters of radio emission from the pulsar P0329 and space plasma.

The geophysical investigations provided for the radio mapping of sectors of the earth's surface and the oceans. Recording radio emissions emanating from land and ocean sectors supplemented data from visual, optical and other observations, for example, on the temperature and humidity of these regions and the atmosphere adjacent to them.

On 9 August, after completing the research program, the cosmonauts separated the antenna. However, complete separation was not achieved. Because of oscillations which had occurred it caught on structural components of the equipment bay. The crew had to exit from the station and separate the antenna using a special tool.



Radio telescope in orbit: 1) multichannel receiver; 2) recorder; 3) unit for shaping precise time signals; 4) control panel; 5) cable withdrawal mechanism; 7) antenna; 8) focal container with receivers; 9) transfer chamber; 10) scientific instrumentation compartment; 11) astroorientation unit.

[181-5303]

5303
CSO: 1866

II. SPACE SCIENCES

SOLAR COSMIC RAYS REGISTERED BY "RADUGA" SATELLITE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19 No 6, 1979 pp 1105-1107

[Article by V. V. Klimenko, I. P. Bezrodnykh, K. A. Vasil'yev and Yu. G. Shafer, Institute of Space Physics Research and Aeronomy, Yakutsk Affiliate, Siberian Department USSR Academy of Sciences, "Solar Cosmic Rays Registered on Geostationary Artificial Earth Satellite on 23 September 1978"]

[Abstract] This paper presents the preliminary results of an analysis of the increase in the intensity of cosmic rays on 23 September 1978. Registry was with a telescope of gas-discharge counters with three energy thresholds for the detection of protons $E_p \geq$ 130 MeV, $\geq$85 MeV, $\geq$45 MeV on the geostationary artificial earth satellite "Raduga." According to data from the Crimean Astrophysical Observatory, during this period on the sun there was a number of spot groups with complex magnetic fields. The times of onset of the intensity increase in all energy ranges virtually coincide and the maximum values were registered at 1250 UT ($E_p \geq 130$ MeV), 1258 UT ($E_p \geq 85$ MeV) and 1345 UT ($E_p \geq 45$ MeV) and constituted $\sim$8.1, $\sim$29.2, $\sim$102.4 particles$\cdot$ $cm^{-2} sec^{-1} sr^{-1}$. The difference in the times of reaching of the stream maximum is evidence of the dependence of the diffusion coefficient for solar particles on energy. The use of an anisotropic diffusion model gave the best agreement with experimental data with a time of onset of injection of solar cosmic rays at the source t_0 = 0945 UT. It was possible to trace the change in the spectral exponent with time if the integral energy spectrum of particles is represented in the form $I_p(>E_p) \sim E_p^{-\gamma}$. During the increase period the spectrum was hardest ($\gamma \sim 2$), at the maximum $\gamma \sim 2.5$, and the softest spectrum ($\gamma \sim 3.2$) was at the end of the increase. Figures 1; references 3: 1 Russian, 2 Western.
[125-5303]

STREAMS OF HIGH-ENERGY PARTICLES IN HIGH LATITUDES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 19 No 6, 1979 pp 988-993

[Article by Yu. V. Gotselyuk, O. R. Grigoryan, S. N. Kuznetsov, V. G. Stolpovskiy and K. Kudela, Institute of Nuclear Physics at Moscow State University and Experimental Physics Institute, Czech Academy of Sciences, "Streams of High-Energy Particles in the High Latitudes Determined from Measurements on Two Artificial Earth Satellites"]

[Abstract] Data obtained during a series of magnetospheric substorms on 27 March 1975 on two satellites, "Intercosmos-13" and "Cosmos-721," are discussed. The materials presented show that the use of two satellites makes possible a more detailed study of the changes in structure of streams of high-energy particles during a substorm. It was found that at quiet times (between substorms) on the morning and evening sides of the earth a weak leakage of electrons is observed in the region of the outer belt at L$\sim$4-5 and a strong leakage is observed at L$\geq$7. Such a structure of streams can be quite stable and can exist for tens of minutes. During the development phase there are large electron streams at L 5-6 in the earth's morning sector ($\sim$ 0000-0400 MLT and possibly later). On the evening side there is a marked increase in the intensity of electrons at L$\sim$10 at $\sim$1600-2000 MLT, where also at quiet times there were greater streams of electrons than at adjacent shells. In the evening and morning sectors streams of protons with $E_p \geq$ 100 KeV appear at L$\sim$15-20. During the restoration phase the electron streams in the morning sector occupy the region L$\sim$4.5-20, decreasing monotonically toward the higher L-shells. In the evening hours increased electron streams also occupy a quite broad region, although intensity peaks at L$\sim$8-10 can be discriminated. This study of electron streams in several substorms, carried out using two satellites, confirms the results of a statistical analysis of change in the structure of streams of particles during the time of magnetic disturbances and makes possible a more precise determination of the temporal scales of existence of particle streams in the auroral zone. Figures 5; tables 1; references 4 (Russian).
[125-5303]

EFFECT OF TROPOSPHERE IN RADIOINTERFEROMETER DIFFERENTIAL COORDINATE MEASUREMENTS

Moscow ASTRONOMICHESKIY ZHURNAL in Russian Vol 56 No 5, 1979 pp 1100-1104

[Article by A. F. Dravskikh and A. M. Finkel'shteyn, Special Astrophysical Observatory USSR Academy of Sciences, "Effect of the Troposphere in Radiointerferometer Differential Coordinate Measurements"]

[Abstract] The turbulent troposphere plays a role in measurements of the coordinates of space sources when using surface radiointerferometers. In actuality, the accuracy of the best radiointerferometer coordinate measurements is close to the limit beyond which the principal role is played by tropospheric effects. The reference object method is effective only in application to measurement coordinates using a time (or phase) lag. Measurements using an interference frequency are considerably less protected against tropospheric noise even when differential observation methods are employed. In this paper the authors, within the framework of a power-law model of an eikonal structural function have obtained estimates of tropospheric limits on the accuracy of phase and frequency differential radiointerferometer coordinate measurements. The influence of time accumulation effects is considered. The analysis shows that differential frequency measurements, in contrast to phase measurements, do not make it possible to realize the full angle-measuring accuracy of a radiointerferometer with superlong bases. A timely problem is direct measurement of the rate of variation of the electric thickness of the troposphere at the points where the interferometer antennas are situated. This problem can evidently be solved by methods similar to those proposed by L. W. Schaper, et al. (PROC. INST. ELECTR. ELECT. ENGIN., 58, 272, 1970.) Figures 2; references 17: 10 Russian, 7 Western. [65-5303]

III. INTERPLANETARY SCIENCES

SOFT GAMMA BURSTS REGISTERED BY 'VENERA' PROBES

Moscow PIS'MA V ASTRONOMICHESKIY ZHURNAL in Russian Vol 5 No 12, 1979 pp 641-643

[Article by Ye. P. Mazets, S. V. Golenetskiy and Yu. A. Gur'yan, Physical-Technical Institute imeni A. F. Ioffe, "Soft Gamma Bursts from the Source B 1900 + 14"]

[Abstract] In addition to the γ-bursts from the source FXP 0520-66, on 24, 25 and 27 March 1979 the "Konus" instrument on the "Venera-11" and "Venera-12" stations registered three soft γ-bursts, similar in their characteristics, which arrived from a source situated near the galactic plane in the constellation Aquila. This source was designated B 1900 + 14. Time profiles of the bursts were obtained with a resolution 1/64 sec in the energy window 50-150 KeV. All three bursts have a very steep leading edge. For the three considered events the time of increase in the intensity of radiation at the very beginning of the burst did not exceed 8 msec. The sharp rise in radiation intensity was replaced by a rapid dropoff. The total duration of the bursts was approximately 120, 190 and 50 msec. The radiation was considerably softer than in the overwhelming majority of studied γ-bursts. It can be said with assurance that the burst of 24 March was the first in a half-year period of observations with an intensity above the instrument response threshold. The principal observational data on these bursts are given in a table. The low galactic latitude of the source, $\gtrsim 4^{\circ}$, can serve as an indication that the distance to it is great. Assuming very arbitrarily that the distance is 1-5 kps, the burst energy is $\gtrsim 10^{39}$ erg. Only the most general hypotheses can be expressed concerning the possible cause of the bursts. Such an energy can be ensured by nonstationary accretion on a compact star or by thermonuclear flares. However, the source B 1900 + 14 seems to be unique in a number of ways. If the bursts in the source are associated with thermonuclear flares, late in March it could be observed as a transient X-ray source with an intensity $\sim 5 \cdot 10^{-9}$ erg/cm^2 sec. Figures 3; tables 1; references 6: 2 Russian, 4 Western.
[158-5303]

REPEATED GAMMA BURSTS FROM THE SOURCE FXP 0520-66 RECORDED BY 'VENERA' PROBES

Moscow PIS'MA V ASTRONOMICHESKIY ZHURNAL in Russian Vol 5 No 12, 1979 pp 636-640

[Article by S. V. Golenetskiy, Ye. P. Mazets, V. N. Il'inskiy and Yu. A. Gur'yan, Physical-Technical Institute imeni A. F. Ioffe, "Repeated Gamma Bursts from Source FXP 0520-66"]

[Abstract] A study of the γ-burst of 5 March 1970 on the basis of data from the "Konus" experiment on the "Venera-11" and "Venera-12" interplanetary stations indicated that its source was an astrophysical object of a previously unknown type--a flaring x-ray pulsar which was designed FXP 0520-66. On 6 March the "Konus" instrument registered a repeated, considerably weaker burst from this same source. On 4 and 24 April the "Venera" instruments registered two other repeated, weak bursts. The fact that all four bursts had a common source was established from the coincidence of the regions of localization in the celestial sphere; identity of the energy spectra served as additional confirmation of this. The article gives details concerning the registered bursts. The principal characteristics of the bursts--onset time T_0, burst intensity S, mean energy flux F--are given in a table. Also given are estimates of total energy of the bursts Q and source luminosity L. These data leave no doubt that the source of these bursts is a neutron star with a strong magnetic field on which very intense nonstationary accretion occurred in the case of the burst of 5 March. It can now be postulated with more assurance than before that such a mechanism is in principle common for γ-bursts. It is possible that the weaker repeated bursts are also caused by accretion, but weaker and transpiring against a background of damping of the perturbations caused by the powerful initial process. A second possibility is that the repeated bursts, weaker by a factor of 300-1000 and with a softer spectrum, are associated with a thermally unstable thermonuclear combustion of matter falling on the surface of a neutron star. In other words, the repeated bursts are close in nature to X-ray bursts, but these particular bursts are considerably shorter and their energy spectra are harder. It is emphasized that the spectra of the repeated bursts are very close in form to the spectrum of the pulsating stage of the burst of 5 March, which was undoubtedly associated with accretion. Figures 4; tables 1; references 9: 7 Russian, 2 Western. [158-5303]

OPTICAL PROPERTIES AND MICROSTRUCTURE OF VENUSIAN CLOUDS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 248 No 3, 1979 pp 568-572

[Article by Corresponding Member USSR Academy of Sciences K. Ya. Kondrat'yev, N. I. Moskalenko and V. F. Terzi, Main Geophysical Observatory, "Optical Properties and Microstructure of Venusian Clouds According to Data on Outgoing Thermal Radiation of the Planet Venus"]

[Abstract] The optical characteristics of the cloud cover in the Venusian atmosphere can be obtained after ascertaining the chemical composition and microstructure of the cloud cover and their variations with altitude. It is now known that Venusian clouds consist of particles of a 75% solution of sulfuric acid. In earlier studies the microstructure of the cloud cover was evaluated using data on light scattering and on the assumption that the microstructure is unimodal and monodisperse. However, the authors feel that such a model poorly describes the spectral structure of the field of outgoing thermal radiation. In actuality, the microstructure of the Venusian cloud cover is dependent on the depth of its local layers and is polydisperse. Accordingly, computations of optical characteristics of a 75% sulfuric acid solution were made for polydisperse microstructures in which the particle-size distributions are described by a modified gamma function $\gamma(r_a) = Cr^a \exp[-br_a^c]$ with different values of the parameters a, b, c. The computed data on the scattering functions and coefficients of aerosol absorption and scattering were used in calculating the spectral intensity of outgoing thermal radiation and the radiation temperature in the spectral region 30-1600 cm^{-1}. The model was that of a two-layered cloud, each of whose layers had its particular microstructure. The computations revealed that the radiation temperature in the spectrum of thermal outgoing radiation agrees with measurement data if the deep aerosol layers have a microstructure with values a = 2, b = 6, c = 0.5, at the same time that the radiation of the upper layers of aerosol is determined by particles of a smaller fraction. A satisfactory agreement of measured and computed radiation temperature spectra is observed if the upper aerosol layer has a microstructure with values of the parameters a = 0.2, b = 6, c = 0.5. This distribution corresponds to a mechanism of formation of Venusian aerosol as a result of photochemical reactions. It is shown that the optical characteristics of the Venusian cloud cover can be obtained from the vertical profile of optical density by superposing these two types of microstructures and also a microstructure of background Venusian aerosol with values of the microstructure parameters a = 1, b = 50, c = 0.5. The scattering and absorption coefficients for the first and second microstructures for a 75% H_2SO_4 solution are given in Tables 1 and 2. The data given in the paper on the microstructure of the Venusian cloud cover and its optical characteristics can be used in computations of the spectral and spatial structure of the field of scattered and thermal radiations in the Venusian atmosphere.
[56-5303]

CO_2 SPECTRAL TRANSMISSION FUNCTIONS FOR MARTIAN ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 15 No 10, 1979 pp 1098-1101

[Article by A. P. Gal'tsev and V. M. Osipov, "CO_2 Spectral Transmission Functions for Conditions in the Martian Atmosphere"]

[Abstract] Carbon dioxide plays the principal role in the Martian heat regimen. In order to take this into account it is necessary to know the spectral and integral transmission functions for the conditions observed in the Martian atmosphere. Computations of the transfer of IR radiation in the Martian atmosphere with use of transmission computed for this particular set of conditions have already been published, but only the integral flux was considered and no data on spectral transparency were given. The objective of the authors is to fill this gap. The principal difficulty in computing Martian transparency is the need to take into account a large number of lines due to the very great CO_2 content. Therefore, in the computations the authors used only lines with an intensity greater than 10^{-8} $cm^{-2}atm^{-1}$ at 200 and 250 K and 10^{-7} $m^{-2}atm^{-1}$ at 300 K. Much numerical data was obtained for the CO_2 absorption bands 2.0, 2.7, 4.3, 9.4-10.4 and 15 μm. The spectral transmission results were described using the empirical formula $\tau = \exp[-\beta u^m p^n]$. The parameters entering into this formula were determined by the least squares method for three absorption bands and these results are given in a table. A comparison of the transmission values computed by a direct method and with the cited formula in general revealed a good agreement with one another. Tables 1; references 9: 8 Russian, 1 Western.
[99-5303]

IV. LIFE SCIENCES

GUROVSKIY REPORTS ON COSMONAUT POST-FLIGHT CONDITION

Moscow MEDITSINSKAYA GAZETA in Russian 1 Jan 80 p 3

[Article by N. Gurovskiy, head of the Administration for Space Biology and Medicine of the USSR Ministry of Health, laureate of the USSR State Prize and doctor of medical sciences, and A. Yegorov, director of the mission medical support group and doctor of medical sciences: "On Stellar Paths"]

[Excerpt] The cosmonauts' [Lyakhov and Ryumin] rapid post-flight recovery was the result of correctly-formulated prophylactic measures. The readaptation period and the difficulties associated with it were less stressful than for preceding crews. Methods of functional activity provided the basis for recovery: regulation of motor activity, initiation and gradual increase of physical exercise, restorative muscle massage, sports, aquatic procedures, fresh air and sunshine--all of these proceeded under strict medical control.

The successful execution of long-term spaceflights does not mean that everything is clear to doctors and that all problems have been solved. Each and every spaceflight brings to light new complex problems and poses new questions. After the flight, decreases in crus circumference and in the calcium content of bone tissue, which are typical and still inescapable symptoms of the effect of weightlessness, were noted in V. Lyakhov and V. Ryumin. Also revealed were changes in salt and water regulation, specifically an increase in the excretion of calcium and magnesium, the aerobic regime of the muscles. There was also a decrease in the number of erythrocytes and in the amount of hemoglobin, both of which were restored during the 5-7th week of the readaptation period.
[203-P]

CSO: 1866

DETECTING TOXIC EFFECT OF BREATHING OXYGEN AT INCREASED PRESSURE

Moscow PATOLOGICHESKAYA FIZIOLOGIYA I EKSPERIMENTAL'NAYA TERAPIYA in Russian
No 5, 1979 pp 82-84

[Article by V. I. Prodin, I. N. Chernyakov, I. V. Maksimov and P. Ya. Azhevskiy, "Complex Method for Detecting the Toxic Effect of Breathing Oxygen at Increased Pressure"]

[Abstract] The authors report on a method which makes it possible to detect early symptoms of oxygen intoxication in man for the purpose of determining hyperbaric oxygenation in sessions which are safe with respect to duration and pressure, employed in eliminating symptoms of high-altitude decompression disease. The investigations were made with the participation of clinically healthy males in the age group 19-28 years in an RKM-1 recompression chamber. The chamber pressure (up to 3 atm) was created by air from cylinders. In order to prevent barotrauma the rates of compression and decompression were constantly monitored using an aviation variometer. The experiment demonstrated the total safety of compression even with a relative inadequacy of barofunction of the middle ear, provided that the compression rate did not exceed 1-3 mm Hg/sec. The rate of safe decompression was 5-10 mm Hg/sec or more. The subjects sat in the chamber in a specially adapted seat, under conditions similar to work during long-term experiments. Two-directional radio communication was maintained with the subjects at all times; the subjects could be observed through a window. Since the toxic effect of high O_2 pressure levels exerts an influence primarily on the state of the central nervous system, cardiovascular system and respiratory system, emphasis was on procedures making possible simultaneous monitoring of the dynamics of these functions. The functional state of the central nervous system was judged from EEG data. The functional state of the cardiovascular system was evaluated by periodic registry of the ECG, arterial pressure and blood stroke volume. Stroke volume was registered using four channel rheoplethysmograph. A block diagram of the apparatus accompanies the text. Thirty-five experiments were carried out with 16 subjects. In 16 experiments the subjects breathed oxygen at a pressure of 3 atm for 90 minutes. Under these conditions only a few subjects by the end of the experiment exhibited initial symptoms of oxygen intoxication which were manifested in the form of nausea, headache and increased arterial pressure. The brief air exposures used during hyperbaric oxygenation, preventing oxygen intoxication, were safe with respect to the development of symptoms of decompression disease with restoration of pressure to 1 atm. Figures 2; references 6: 5 Russian, 2 Western.
[118-5303]

V. SPACE ENGINEERING

TWO VIEWS ON FUTURE OF SOVIET SPACE TECHNOLOGY

Paton on Three Main Directions To Be Pursued

Kiev PRAVDA UKRAINY in Russian 16 Oct 79 p 3

[Interview with Boris Yevgen'yevich Paton, director of the Institute of Electrical Welding and president of the Ukrainian Academy of Sciences: "Space Technologies"]

[Editorial report] Commenting on future prospects for the development of space technology in the Soviet Union, Academician B. Ye. Paton noted three main directions to be pursued: 1) constructing orbital stations and other structures in space, making use of special welding techniques, thin metal sheets and folded structural components, 2) repairing and restoring a station's scientific equipment and flight and life support systems rather than delivering replacement equipment from earth, and 3) producing materials in zero-gravity conditions.

> "From my point of view they [space technologies) will be developed along three basic directions. The first concerns construction and assembly operations in space. Already in the 1960's S. P. Korolev expressed the idea of using so-called 'transforming' structures which are folded into small parcels on earth and then transported and deployed in space. Weightlessness creates some interesting possibilities here. Welding would be required in the assembly of such structures.
>
> "Weightlessness can also help in the creation of structures and compartments of future orbital stations made of very thin layered metal and even foil.
>
> "When all of this passes beyond the stage of laboratory testing and into practical cosmonautics on the scale of production (factories in orbit), the time will come for welding operations in space. And in the future the welding and cutting of metals and other materials will be required for distant interplanetary flights and then for building orbital living and production centers.

"However, we will return to tasks closer at hand. The longer an orbital station is in operation, the more often restoration and repair problems will arise--this is the second direction in developing space technologies. It is better to restore units where they are functioning in space rather than to deliver new units from earth.

"The third direction is the development of space technologies that would make it possible to obtain unique materials in orbit."

Sevast'yanov on Orbital Stations

Tallin SOVETSKAYA ESTONIYA in Russian 5 Dec 79 p 3

[Interview with V. I. Sevast'yanov, USSR pilot-cosmonaut and candidate of technical sciences: "Earth--Space--Earth"]

[Editorial report] According to comments made during an interview in Tallin in December, former Cosmonaut Sevast'yanov foresees the future development of three main types of specialized orbital stations: 1) geophysical laboratory stations for environmental monitoring and astronomical observations, 2) materials processing stations, and 3) energy supply stations.

"In near-earth orbits there will be scientific stations designed for studies of the earth and near-earth space as well as remote regions of the universe using astronomical instruments placed beyond the earth's atmosphere. These are geophysical stations. They will be able to study the earth's natural resources and monitor the natural environment. These will be manned laboratories where instrumentation can be refined to the point where all operations can be done automatically. And then there will be modular scientific stations. Each module will have its own special purpose. A module will be equipped with the apparatus necessary for a definite research program and will be delivered to a station composed of other compartments and modules, including living and sleeping quarters, etc. Throughout an expedition the modules could be exchanged. In overall size and volume each module would be like our Salyut station. This is the first direction.

"The second is to solve technological questions--that is to say, technology in space and, in the future, factory-stations, on board which technological processes impossible under the conditions of gravity will be conducted. On these stations, for example, crystals needed for electronics will be grown."

"In space we will be able to obtain super-pure pharmaceuticals."

"Another goal is to obtain composite alloys."

"In near-earth orbits there will be atomic electric power stations and electric power stations with solar panels (converting solar energy into electricity and transitting this energy to earth perhaps by laser).

"From these proposed directions it is evident that one of the major purposes for orbital stations is to serve man's economic activity."

[162-P]

CSO: 1866

SPECIAL FAMILY OF CARRIERS FOR IMPLEMENTING SPACE RESEARCH PROGRAM

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 17 No 6, 1979 pp 938-941

[Article by A. V. Sollogub, "Choice of a Family of Carriers for Implementing a Space Research Program With Restriction on the Number of Carriers"]

[Abstract] The space research program discussed here, as in the author's earlier investigation (A. V. Sollogub, et al, KOSMICH. ISSLED., 15, No 6, 1977), is determined by the three-element series $\langle G, m, k\rangle$, where $G = (G_1, G_2, \ldots, G_k)$ is the vector of space vehicle weights (the vector elements are arranged in increasing order), $m = (m_1, m_2, \ldots, m_k)$ is the vector of the number of vehicles, k is the space vehicle nomenclature. In this program for selecting the family of carriers for implementing a space research program with limitations on the number of carriers it is necessary to determine the family of carriers $G_{pay} = G_{pay\ 1}, G_{pay\ 2}, \ldots, G_{pay\ t})$, the program for their construction $n = (n_1, n_2, \ldots, n_t)$ from the condition of satisfaction of the entire program with minimum expenditures Z and in the presence of restrictions on the number of types of carriers; $G_{pay\ i}$ is the maximum payload for which a carrier of the i-th type was designed, n_i is the required number of carriers of the i-th type, t is the number of types of carriers. The number of types of carriers must not exceed T($t \leq T$). It is assumed that the carrier is for one-time use only and that one carrier can put only one space vehicle into orbit. Formulas are given for the expenditures Z on an optimum program and the optimum number of carriers. Tables 1; references 1 (Russian). [136-5303]

MULTISTEP ALGORITHMS FOR SPACE VEHICLE CONTROL

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 17 No 6, 1979 pp 835-845

[Article by V. V. Salmin, "Multistep Algorithms for Control of Space Vehicles"]

[Abstract] In the choice of algorithms for the control of a space vehicle a factor of considerable importance is the uncertainty in the mathematical model of the operative perturbations, leading to considerable errors in the final trajectory parameters. The author proposes a multistep algorithm for adaptive control based on a preliminary choice of base regimes for programmed control, successive refinement of the model of perturbations and the vector of phase coordinates, prediction of motion to the end of a stipulated time interval and computation of corrections to the parameters of the control

law, reducing the predicted final miss to zero. The realization of such an algorithm assumes the availability of a high-speed digital computer in an autonomous system for space vehicle control. The article gives examples of computations characterizing the operability of the algorithm in problems of correction of elliptical orbits, plane and spatial interorbital transfers of space vehicles with low-thrust electrojet engines. The principal perturbing factor in the modeling of the control processes was the drag of the upper layers of the atmosphere, for which the mathematical model of density is known with an inadequate accuracy. The modeling demonstrated the effectiveness of the proposed multistep adaptive algorithms. Figures 5; tables 2; references 14 (Russian).
[136-5303]

QUALITY INDICES FOR RENDEZVOUS SYSTEM FOR TWO SPACE VEHICLES

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 17 No 6, 1979 pp 846-851

[Article by N. S. Gubonin, A. I. Karetko and L. V. Krinitsin, "Quality Indices for Rendezvous System for Two Space Vehicles in Cases of Failure (With Restoration) of Measuring Instruments in Rendezvous Process"]

[Abstract] The influence of interruptions in the control of a space vehicle on the reliability of the system for rendezvous of two space vehicles is investigated. These interruptions are possible due to failures of control apparatus with subsequent restoration of performance or as a result of cutting off the measurement apparatus for its in-flight preventive maintenance. The objective of the authors is an examination of methods for determining the indices of reliability of the rendezvous system: the probability of successful approach and the probability of failure. Digital modeling was used in obtaining the dependence of the mathematical expectations and correlation matrix of the normalized values of characteristic velocity, maximum propulsion and approach time of two spacecraft on the normalized moment of failure a_1 of measurement systems and the length of time required for restoring their operability a_2 in the approach process. Expressions for the probability of normal functioning of the approach system of two spacecraft as a function of the a_1, a_2 parameters are derived within the framework of a Gaussian approximation. This is illustrated in an example. Figures 3; tables 3; references 5 (Russian).
[136-5303]

ALGORITHMS FOR FORMING COMMAND BANKING ANGLE DURING ENTRY INTO ATMOSPHERE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 17 No 6, 1979 pp 852-857

[Article by V. L. Balakin and L. V. Morozov, "Algorithms for Forming Command Banking Angle During Entry of a Space Vehicle With High Aerodynamic Quality into Atmosphere"]

[Abstract] The authors of an earlier study (D. Ye. Okhotsimskiy, et al, ALGORITMY UPRAVLENIYA KOSMICHESKIM APPARATOM PRI VKHODE V ATMOSFERU, "Nauka," 1975) developed multistep adaptive atmospheric entry control algorithms in which the command banking angle is determined on the basis of predicting the final miss from the calculated landing point. The effectiveness of these algorithms has been confirmed in the modeling of atmospheric entry of descent modules having low aerodynamic quality $k \sim 0.3$. In this paper the authors investigate algorithms for forming the command banking angle for controllable descent of vehicles with a high aerodynamic quality ($k \geq 1$) from an artificial earth satellite. The problem of synthesis of the descent control law is divided into two parts: formulating a reference control program without allowance for the operative perturbations and determining correcting factors for decreasing the scatter of landing points. In developing the algorithm it is assumed that space vehicle descent occurs in a balanced angle of attack and control occurs due to a change in the banking angle. The reference control program ensures: 1) guidance of the vehicle to any point lying in the admissible landing region; 2) satisfaction of the limitations on acceleration and heat flow; 3) economy of fuel expenditures on vehicle stabilization. The proposed algorithms have a high accuracy and make it possible to compensate for considerable (even several thousands of kilometers) initial deviations of the trajectory from the calculated landing point. Figures 2; tables 5; references 1 (Russian).
[136-5303]

METHOD FOR TRIAXIAL STABILIZATION OF SPACE VEHICLE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 17 No 6, 1979 pp 932-934

[Article by A. V. Prasolov, "Triaxial Stabilization of a Space Vehicle Using an Impulse Control System"]

[Abstract] Different kinds of pulsed control systems have now come into wide use for solving the problems involved in stabilization of space vehicles, which is dictated by the need to conserve fuel. The combined method of pseudovelocity modulation, based on the use of a relay amplifier with a flexible feedback in the form of an inertial link, has gained the widest acceptance. The author of this paper proposes that feedback equations for each control channel be added to the system of equations for rotational motion of a spacecraft. The proposed broadened system of differential equations reads:

$$\theta\dot{\omega} + \omega_x\theta\omega = u, \qquad \dot{\lambda} = 1/2\ (\lambda_0\omega + \lambda_x\omega),$$

$$\dot{\lambda}_0 = 1/2\ (\lambda,\omega), \qquad x = -Tx + Ku, \qquad (1)$$

where θ is the tensor of space vehicle inertia; ω is the angular velocity of space vehicle rotations; $\{\lambda_0, \lambda\}$ are the Rodrigues-Hamilton parameters; $x = \{x_1, x_2, x_3\}$ are the signals from the three feedbacks for the control channels; T, K are diagonal matrices with the positive elements T_i, K_i; u are the controlling moments of the system. System (1) has the integral

$$\lambda_0^2 + \lambda^2 \equiv 1. \qquad (2)$$

The control $u = u(\omega, \lambda_0, \lambda, x)$ is sought for satisfying the properties: 1) $u(0, \pm 0, 0) = 0$; 2) the position of equilibrium of system (1)

$$\omega = 0, \qquad \lambda_0 = \pm 1, \qquad \lambda = 0, \qquad x = 0 \qquad (3)$$

has such an ε-neighborhood that if the solutions begin in it, then they will always remain in it when $t \geq 0$. It is shown that in the region

$$|\lambda_0| > 0 \qquad (4)$$

the control

$$u = -M(\omega + D\eta + Cx) \qquad (5)$$

solves the stabilization problem with satisfaction of certain conditions. The control (5) is stabilizing everywhere when $|\lambda_0| > 0$, and the solution beginning in region (4) remains there. References 3 (Russian).
[136-5303]

LABORATORY PLANETARIUM CONSTRUCTED AT COSMONAUT TRAINING CENTER

Moscow PRAVDA 28 Nov 79 p 6

[Article by N. Mishin: "Familiar with the Stars"]

[Abstract] PRAVDA correspondent Mishin reports on the planetarium recently constructed for training purposes at the Cosmonaut Training Center in Zvezdnyy Gorodok ("Star City"). It is equipped with instrumentation developed by the GDR;s Karl Zeiss Jena enterprise within the framework of the "Intercosmos" council for scientific and technical cooperation in the field of space research.

In contrast to conventional planetarium, this laboratory planetarium, whose dome is 12.5 meters in diameter, is designed to simulate the sky only as it appears to the crew of a spacecraft in near-earth orbit. For this reason the horizon is lowered by 15 angular degrees. A computer designed to simulate flight conditions can be programmed to project onto the dome segments from actual spaceflights, producing the sensation of certain maneuvers of the spaceship in space conditions as they would appear through the craft's windows.
[161-P]

VI. SPACE APPLICATIONS

NELEPO COMMENTS ON DEVELOPMENT OF AUTOMATIC OCEAN SURVEILLANCE SYSTEM

Moscow VODNYY TRANSPORT in Russian 25 Dec 79 p 3

[Article by M. Chernyshov: "They are studying the ocean from space"]

[Excerpt] "In the end," B. Nelepo, director of the Ukrainian Academy of Sciences' Marine Hydrophysical Institute, added, "it all comes down to the development of a continuously operating automatic system for observing the ocean from space. Why is it of interest to study not only the ocean surface layer but its depths as well? And is it possible to look into [the depths]? When Vitaliy Sevast'yanov told specialists that from orbit he could see the Mid-Atlantic ridge, many were doubtful. Now it is well known that the ocean surface layer repeats the underwater relief, and that there are "rises" and "falls." Internal waves, which, as a rule, are propagated within the ocean depths but sometimes also emerge onto the surface, can serve as a kind of "projector" for studying the depths.

"In all, our task lies in learning to recognize the useful signals that the ocean sends to us. What kind of observations can be conducted, let's say, in the infrared range? In what cases would it be preferable to use radio waves? In what part of the spectrum would it be most advantageous to photograph with color film? All of these questions require a lot more work. The experience accumulated to date in this field is already extensive. In particular, the specialized oceanographic satellite "Cosmos-1076," which was launched not long ago, has yielded much useful information. Other space vehicles are also in operation. But in order to develop them further, the aid of our cosmonauts is unconditionally necessary."
[202-P]

COMMENTARY ON 'COSMOS-1151' OCEANOGRAPHIC SATELLITE

Moscow PRAVDA in Russian 26 Jan 80 p 6

[Article by Academician B. Nelepo, Ukrainian Academy of Sciences, director of the Marine Hydrophysical Institute: "Satellites over the Ocean"]

[Text] Cosmos-1076, our nation's first specialized oceanographic satellite, has been in orbit for nearly a year. During its flight a great deal of scientific information has been obtained and is being processed in laboratories throughout the country. At the same time, methods for measuring ocean surface features are being refined, and the relationship between the surface and deep ocean processes is being defined.

Already the first results of the measurements conducted synchronously from Cosmos-1076 and from aboard the scientific research ships "Mikhail Lomonosov" and "Moldaviya," have shown that the scales of the inhomogeneities manifest in the ocean surface layer practically coincide in both cases. And this signifies that the principles providing the basis for remote sensing detectors are valid.

Studying the ocean from aboard a satellite is significantly different from measurements over the continents. It is true that the variety of colors and shadings of land is incomparably more extensive than that of ocean expanses. Various natural formations on continents are, as a rule, contrastive and have rather definite delineations. The space data for these targets are easily deciphered and geographically referenced, but at the same time the instrumentation must have a high spatial resolution capability. Ocean features are ten times less clearly expressed, and the geographical referencing of data is much more complex. It is for this reason that the sensitivity and spectral selectivity of oceanographic satellite sensors must be much greater while only a lesser resolution capability is required.

These concepts were confirmed to a significant degree through the studies conducted from Cosmos-1076 in the visible range of the spectrum. In processing the results of measurements made, it became apparent that because of the influence of atmospheric haze, the data obtained from orbit on the brightness of the ocean's color "palette" (zones of increased biological productivity can be distinguished by color) were lower than expected. The exceptionally valuable observations conducted by cosmonauts on board the Salyut-6 orbital station also helped to refine methods for interpreting useful information in the visible range of the spectrum.

Not all of the difficulties have been overcome. In particular, it remains to learn to account for the influence of changing atmospheric characteristics on the results of measurements. But the results obtained suggest ways of solving the problems. It was shown that it is possible to reveal by

means of automatic space systems regions of severe storms and intense temperature anomalies as well as areas of highest ice density in the arctic basin and to calculate the water vapor content of the atmosphere. We better understand the scattering of radiowaves by a turbulent sea surface, which made it possible to create a methodology for determining the basic parameters of marine turbulence and wind in the ocean-atmosphere boundary layer by means of radar.

It must be noted that radar instrumentation for remote sensing together with IR and microwave-range radiometric apparatus provide the basis for an all-weather research complex. They make it possible to reveal practically all of the basic features of the ocean surface and atmosphere accessible to remote measurements.

Armed with knowledge gained from Cosmos-1076, scientists prepared Cosmos-1151 for flight. With it the refinement of methods for remote measurements of the parameters of the ocean surface layer and the atmosphere will be continued. At the same time, it is proposed to resolve a number of concrete scientific problems connected with the comprehensive evaluation of results from synchronous observations of various parameters of the marine environment.

The complex, which consists of on-board scientific equipment and control and calibration facilities installed on scientific research ships and measuring ranges, began operating on 23 January. Scientists are awaiting valuable results.
[196-P]

CSO: 1866

SOVIET SATELLITE NAVIGATION SYSTEM IMPLEMENTED

Receiving Equipment Installed on Ships

Vladivostok Domestic Service in Russian 0930 GMT 16 Jan 80

[Text] Equipment for receiving navigation information via a communications satellite is being installed in ships of the Far East basin. The new equipment has been received by fishing scientific research and other ships of the "Dalryba" association operating in remote areas of the ocean. Ships of the Far East Steamship Company are being prepared for installation of this equipment.

Preparations Made for Space-Aided Navigation

Moscow TASS in English 1053 GMT 17 Jan 80

[Text] Equipment for receiving navigational information via space satellites is being installed on merchant ships, fishing vessels, research vessels and other ships sailing in the waters of the Soviet Far East. Arkadi Lavrov, head of the Service of Security of Navigation in the Soviet Far East, told a TASS correspondent that the use of satellites sped up several times the delivery of information and improved the quality of communications. It no longer depends on ionospheric conditions. Preparations are underway in the USSR for the implementation of the international convention envisaging the setting up of a communications system with the use of satellites for the needs of navigation being created on the Soviet Union's initiative. Socialist, capitalist and developing countries are participants in the convention. Its implementation will make it possible to remove the danger of accidents and will make for more effective navigation of ships.
[199-P]

NETWORK OF ARTIFICIAL EARTH SATELLITES FOR STUDYING NATURAL RESOURCES

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 17 No 6, 1979 pp 945-948

[Article by V. S. Konstantinov, A. A. Lebedev, V. A. Strel'tsov and M. M. Khrustalev, "The Problem of Forming a Network of Artificial Earth Satellites for Investigating the Earth's Natural Resources"]

[Abstract] The article formulates the problem of determining the principal parameters in a space system and proposes an approach to its solution based on the theory of optimization of multipurpose systems. The proposed space system is intended for solution of a wide range of problems in the national economy; and its effectiveness is evaluated using several indices: the system must function under diverse conditions and must consist of several autonomous subsystems. In solving the problem only circular orbits are considered because they ensure a constant spatial resolution of images (which is important in interpreting the photographs) and are more stable (which is important for creating a long-lived system). It is further assumed that any problem in the national economy can be solved simultaneously by several types of artificial earth satellites. The fundamental criterion for the proposed system is economic: the gain to the national economy. The authors give the formulas for determining the optimum parameters of the proposed system. It is shown that the approach to the problem of constructing a space system based on the theory of multipurpose systems makes it possible to formalize and separate the problem into two subproblems which can be solved using the known methods of mathematical programming and vector optimization.
[136-5303]

PETROV COMMENTARY ON IMPACT OF SPACE TECHNOLOGY ON OTHER S&T FIELDS

Moscow ZEMLYA I VSELENNAYA in Russia No 2, 1979 pp 4-8

[Article by Academician B. N. Petrov: "Cosmonautics and Scientific and Technical Progress"]

[Text] The successes of space science and rocket and space technology are inseparably associated with scientific-technical progress on the earth. This relationship is manifested in different aspects--scientific, technical and social.

***

New Directions, New Problems. During the years of the space era rocket and space technology and space science have covered a great distance. Fundamentally new engineering solutions have been found, different classes of launchers and space vehicles--satellites, manned and unmanned transport ships, orbital stations, automatic interplanetary stations--have been created, many outstanding flights and unique experiments have been carried out and a new direction in science has been born.

Space research has led to the development of new directions in the natural sciences. A clear example is the founding and rapid development of exoatmospheric astronomy (ZEMLYA I VSELENNAYA, No 5, 1977, pp 29-32.--Editor's Note). Because space technology has made it possible to put scientific instruments beyond the limits of the earth's atmosphere, it has become possible to study the sun, stars, galaxies and extragalactic sources in the short-wave range of electromagnetic radiations--ultraviolet, X-ray and gamma ranges, which are inaccessible for ground observatories since they are completely absorbed by the earth's atmosphere. Short-wave emissions carry an enormous amount of information concerning the processes transpiring on various celestial bodies.

Other directions in the natural sciences born of space research are also developing intensively. These include space biology and medicine, remote sensing of the earth, space meteorology, space geodesy and others.

The creation of rocket and space technology has led to substantial progress in the technical sciences. Completely new directions have appeared: space-flight mechanics, theory of rocket engines, theory of flight vehicle control, space radioelectronics. In the development of space technology it is possible to find many shining examples of the dialectic interaction of theory and practice. The difficult tasks of creating rocket and space systems and their components gave rise to new theoretical directions and new computation methods, and required the use and considerable improvement of mathematical support. In turn, theoretical generalizations and new concepts and methods for planning made it possible to creat fundamentally new technical systems.

The development of rocket and space technology has no precedent with respect to the rate and time period for creating highly elaborate complexes or the number and diversity of the types of rocket and space systems developed and the apparatus included in them.

Problems in rocketry. These are completely new engineering problems which simply did not exist 40-50 years ago. The path followed by this field of technology required thorough investigation, and some of the problems associated with the creation of the technical apparatus in rocketry during this brief time changed in content and required a new approach for their solution.

An example is the choice in the number of booster-rocket stages. It has been known since the time of K. E. Tsiolkovskiy and other founders of cosmonautics that the greater the number of rocket stages, the greater is the payload which can be put into orbit with one and the same launching mass. True, with an increase in the number of stages this advantage from each new stage undergoes a relative decrease. As rocket technology developed, the number of rocket stages increased. First a single-stage rocket was created, followed by two- and four-stage rockets. A modern Japanese solid-fuel rocket, which launches artificial earth satellites into orbit, has four stages. At the same time, powerful, reusable space vehicle boosters which have only two stages are being developed and are already undergoing tests in the United States. American specialists are also working on the creation of a single-stage "space shuttle." What is the reason for this? To be sure, it is not because the formulas determining the effectiveness of multistage rockets were incorrect or that multistage rockets do not give a gain in payload. The fact is that the criteria on the basis of which a rocket and space vehicle system is constructed are changing. The decisive question remains as to which is more important: to put into orbit an extra hundred or two hundred kilograms or even several tons, or to ensure simplicity of operation, reliability and economy of the system, successively putting into orbit the necessary amount of payload over the course of a pre-determined period of time: one, two, five years.

A re-examination of the criteria on the basis of which many decisions are made is characteristic of the modern stage in the development of rocket and space technology. Particularly productive here is the systemic approach, with an evaluation of all combined factors ensuring a high effectiveness, economy and operational reliability of different space vehicles and entire complexes.

We can cite examples of many successful technical solutions found during the first years of the development of practical cosmonautics which stood the test of time and are now being applied. These include the scheme for parallel-serial separation of the stages of boosters used in launching the "Vostok," "Voskhod" and "Soyuz" spaceships, the scheme for supporting on the launch pad these same rockets, which separate under the influence of counterweights during rocket ascent, etc.

Propulsion systems. Here also there are many debatable problems whose solution is dependent on the level of technological development, the availability of necessary materials and the proposed objective. These include a determination of the number of individual engines and the number of nozzles for each engine for a given total power output, the choice of the optimum regime and reserve relative to the maximum admissible level, and the choice of the type of fuel, in particular, the choice of components with high or low boiling points, taking into account their advantages and shortcomings. The ever-expanding use of hydrogen requires a re-examination of many technical solutions and is stimulating the creation of new materials. An important stage in the development of space propulsion will be the use of ion and plasma engines and on-board nuclear reactors.

New materials. The progress of rocket and space technology led to the creation of new materials with properties that had not been needed earlier. In particular, materials intended for use at both exceedingly high and ultra-low temperatures were required. Exceptional requirements are placed on their strength and operating characteristics. The need arose to use titanium, beryllium, composite and ceramic materials. It was necessary to create super-pure materials which ensure the high operational reliability of microelectronics and semiconductor technology.

The materials and elements created for the needs of space technology are also being used successfully in other fields of technology, thereby ensuring the prospects for rapid progress in these fields.

In the area of control the matter of creating highly effective means of control, based on the latest achievements in electronics and microelectronics, became particularly acute. In connection with the development of space technology new directions were opened up in the field of control theory, a class of extremely effective adaptive and self-adjusting systems, i.e., systems with a variable structure, appeared, terminal systems were devised and theory was refined. Terminal systems do not require high-quality regulation and control in the course of the entire process, but only at a definite moment in time or a definite point in space--during the landing or docking of space vehicles when the velocity must be reduced to a minimum and it is necessary to ensure a smooth, soft approach of spaceships to one another or to the landing site. There was particularly intensive development of the mathematical theory of such systems, in particular, systems of the discrete type, applicable to the problem of rational expenditure of fuel during the operation of flight vehicles. The problem of economical, optimum expenditure of fuel arises in the solution of any problems in space technology, whether reference is to the launching of a space vehicle into orbit or maneuvering in orbit, trajectory correction, stabilization or the docking process.

On-board computers and systems. In essence the development of microelectronics was stimulated by the problems of space technology. Requirements appeared which had not been raised earlier in any other fields of modern technology.

For example, the development of on-board systems posed before their creators --designers and scientists--the problem of ensuring the high reliability of systems constructed from components of a limited, sometimes low reliability. In other words, the problem was in creating reliable systems from components of low reliability. Thirty or fifty years ago such a problem could only evoke a smile. However, history made it necessary to solve such problems and effective systems having a high reliability appeared. The principles for duplication and triplication of components and units, and sometimes entire systems, were developed. The "voting" principle came into broad use; under this principle the signal is considered reliable if there is coincidence of signals at the output of two circuits out of three or three out of five.

However, if a dialectic approach is used, then we must evaluate whether this approach is viable and whether it should be used in all cases. Experience dictates an increase in the reliability of the components themselves and the primary circuits. Substantial progress is noted in connection with the development of microelectronics. The reliability of solid-state components--large integrating circuits made using a single crystal--is considerably greater than the reliability of similar circuits created from individual semiconductor elements.

The development of fundamental methods for increasing reliability affords great possibilities. Now ideas related to the creation of highly reliable circuits for computers are appearing. Existing computers are constructed on a binary reckoning principle and their logic circuits on the basis of Boolean algebra and its further development. New approaches to the construction of computers and their networks will be afforded by the use of self-correcting codes. In the future this will avoid the duplication and triplication of circuits and time expended on periodic checking to see if they are operating properly. I believe that I will not be mistaken if I say that with the further development of technology, the relative role of duplication and triplication of systems will be reduced and for many tasks it will be possible to get by without this; and accordingly, this will avoid the associated increase in system weight. This approach will be kept only for especially important cases when it will be necessary to employ duplication despite the great reliability of individual components and circuits.

Automated control systems. The creation of complex automated control systems, including man and groups of persons at different levels of the control hierarchy, is a current task in modern science and technology. It arises both in the field of space technology and in different branches of the national economy. Typical examples of highly complicated complexes are the automatic system for monitoring launch preparations and automatic systems for space vehicle flight control. Until recently the most complex operating complex was the flight control complex for the "Soyuz" and "Apollo" spaceships. Then a complex system, consisting of two Flight Control Centers

and situated on different continents (near Moscow and in the southern United States, at Houston), a network of Soviet and American tracking stations, situated on land and on ships, and a communication system, including surface and underwater communication channels and communications satellites, was created. This system maintained communication with the crews at all points in orbit, made it possible to carry out conversations, receive television transmissions from aboard space vehicles and transmit necessary commands, and ensured interaction between the Flight Control Centers.

The experience accumulated in the creation and operation of such a system is extremely useful in other fields of technology as well.

Space and the National Economy

The attainments in the production of rocket and space technology--technological processes, materials, instruments, assemblies--are systematically being adopted by other branches of the national economy. For example, heat-resistant alloys and microelectronic components developed for on-board equipment are also being used successfully in other fields of technology. Limitation on the size and weight of instruments--an important requirement in space technology--exerted a substantial influence on progress in microminiaturization of technical means in general and electronics and computer technology in particular. The necessity for reworking great stores of information and the complex computations associated with ballistic calculations and space vehicle flight control exerted an influence on progress and the creation of universal high-speed electronic computers.

The biomedical instruments created for investigations in the field of space biology and medicine and the unique instruments for operation under orbital flight conditions are finding ever-increasing practical applications on earth. For example, the Soviet physician Yu. A. Senkevich took with him aboard the reed boat "Tigris" a set of instruments, tools and medicines similar to those developed for space flights.

Communications satellites of the "Molniya" series, which operate in elliptical orbits, and the "Orbita" system of ground stations made it possible to have coverage of enormous territories of our country via space communications facilities (ZEMLYA I VSELENNAYA, No 5, 1977, p 8-15. Editor's Note). The "Intersputnik" organization was also created; its system ensures television, telegraph and telephone transmissions to Cuba, Mongolia and a number of European CEMA countries. A new stage in the development of space communications was the creation of the "Raduga" and "Ekran" geostationary communications satellites. The "Ekran" satellites ensure transmission of color television to many regions in the country, including the Baykal-Amur Railroad construction areas, and do not have the restrictions associated with relative motions of a satellite (ZEMLYA I VSELENNAYA, No 1, 1978, pp 27-31. Editor's Note). It is difficult to overestimate the value of further

improving of space communications facilities for cultural development and social progress.

In the future it is possible to expect the creation of highly complex systems for the exchange of information via communications satellites and international data "banks" which will be accessed by many countries. Direct television broadcasting via geostationary communication satellites to rooftop antennas or very simple collective use antennas is becoming a real goal.

Space meteorology has occupied an important place in modern science and technology. The activity of the weather service without the use of meteorological satellites is now unthinkable (ZEMLYA I VSELENNAYA, No 5, 1977, pp 16-24. Editor's Note). The information received from meteorological satellites in making only one revolution in orbit exceeds the information which is supplied by 10,000 meteorological ground stations in 24 hours. Space meteorology is making possible a considerable increase in the reliability of weather forecasting. Satellite information on ice conditions is of great practical importance for convoy ships in the Arctic basin. In particular, such information was used extensively during the noteworthy cruise of the "Arktika" atomic icebreaker to the North Pole (ZEMLYA I VSELENNAYA, No 1, 1978, pp 2-3. Editor's Note). With the development of actual year-round navigation along the Northern Sea route, satellite information is becoming still more necessary. Investigations of the atmosphere and the interaction between the earth's surface, ocean and atmosphere and the study of cloud and ice cover are deepening our knowledge of the processes transpiring in the earth's atmosphere and hydrosphere. It is difficult to overestimate the value of warnings about cyclones, hurricanes and typhoons. Such information, which is collected by the coastal services and ships in the oceans and seas, will make it possible to prevent impending navigational catastrophes and save many human lives. All this will have an enormous economic effect, and, to be sure, will yield results which cannot be evaluated in rubles or dollars.

The introduction of space navigation systems is affording great possibilities. These will make it possible to determine, with a high degree of accuracy, the position of ships and aircraft, in whatever region of the earth they may be located.

Now an agreement has been reached on cooperation with the United States in the development and creation of a system for communicating data on the position of ships and aircraft which have experienced misfortune. Such a system should consist of several satellites and rescue receiving stations. On aircraft and ships, and possibly in geological parties and expeditions, small radio transmitters will be switched on during emergencies and will transmit a distress signal. The satellites will relay this signal to receiving stations and it will be transmitted to the closest rescue station.

Such a system can save many human lives since, as indicated by statistics, a high percentage of the losses is associated with late detection of an aircraft or ship which has experienced an accident or emergency.

With the development of space technology and improvement in on-board apparatus, especially photographic and television equipment, greater and greater possibilities are opening up for the study of natural resources from space (ZEMLYA I VSELENNAYA, No 2, 1977, pp 10-15. Editor's Note). For this purpose the "Salyut-6" orbital station carried the improved MKF-6M apparatus, which is used in carrying out a program for photographing the earth's surface.

A service for preserving the environment and contending with its contamination will be created in the future on the basis of space methods for studying natural resources.

Among the new directions in the development of technology having direct practical value is space technology (ZEMLYA I VSELENNAYA, No 6, 1978, pp 24-28. Editor's Note). An important trend in space technology is the development of technological processes intended for carrying out various operations in space: assembly of equipment, assembly of structural components and repair operations. Among such operations are, for example, different types of welding and cutting in space and opening up folded and rolled materials and structural components.

The global nature of many space research tasks and the need for complex experiments with the consolidation of efforts of scientists in different countries has led to international cooperation and has required the development of new forms of effective and mutually advantageous cooperation. A good example of productive cooperation in the field of exploration and use of space for peaceful purposes is the joint work of the scientists and organizations of the nine socialist countries participating in the implementation of the "Intercosmos" program (ZEMLYA I VSELENNAYA, No 6, 1977, pp 23-29. Editor's Note). The positive experience of such cooperation can be successfully applied in other fields of science and technology as well.

Without question the further scientific, technical and social progress of mankind is inseparably associated with space research.

[114-5303]

5303
CSO: 1866

VII. SPACE POLICY AND ADMINISTRATION

SAGDEYEV REMARKS ON FUTURE INDUSTRIALIZATION OF SPACE

Tallin SOVETSKAYA ESTONIYA in Russian 7 Dec 79 p 1

[ETA Report: "On Space Topics"]

[Editorial Report] R. Sagdeyev, director of the Space Research Institute (IKI), was interviewed in Tallin during a seminar sponsored by the "Znaniye" society on the "Latest Achievements in Space Research and Problems of Propaganda." In his remarks to the ETA correspondent, he briefly noted recent Soviet achievements in the manned space program, interplanetary exploration and international cooperation in space and speculated that extensive industrialization of space would begin in the next 5-10 years:

> "In the past few years our country has taken a great step forward in the conquest of space. We have attained practically continuous manned operations in orbit; at the end of last year there was what I would call an explosion of new information on the chemistry of Venus; and there is an entire group of wonderful young scientists concentrating in the space sciences. Also among the most significant achievements is the sharp increase in the role of international cooperation in space research, which has been evident in the flights of the CEMA cosmonauts and in the cooperation with various other countries in the realization of scientific and technical programs in space, including the joint work with our French colleagues.
>
> "I am certain that in the next 5-10 years a vast amount of industrial activity will begin in orbit. Toward that end we must prepare not only technology but men as well."

[201-P]

CSO: 1866

TASS NOTES COMMERCIAL AVAILABILITY OF FRENCH 'ARIANE' BOOSTER

Moscow IZVESTIYA in Russian 24 Jan 80 p 3

[TASS Report: "On a Commercial Basis"]

[Text] France intends to put the production of the "Ariane" rocket, which is designed to orbit artificial earth satellites, on a commercial basis.

This announcement was made by the head of the European Space Agency R. Ory, who is responsible for the "Ariane" program. He, in particular, noted that the creation of a private industrial enterprise is being planned to promote the commercial use of the "Ariane" booster, which was developed by France in conjunction with other West European nations.

It is expected that this group will offer to other nations and companies its service of "launching satellites of various designations."
[197-P]

CSO: 1866

SOVIETS ANNOUNCE 'ARCAD-3' PROGRAM SLATED FOR 1981

Moscow TASS in English 1301 GMT 6 Feb 80

[Editorial report] Nikolay Novikov, deputy chairman of the USSR Academy of Sciences' Intercosmos Council, has announced to a TASS correspondent that the joint Soviet-French ARCAD-3 space experiment is to be conducted in 1981. Instrumentation to be designed by engineers from both countries will be installed on board a Soviet-launched INTERCOSMOS satellite intended for the study of ionospheric and magnetospheric phenomena, including the polar lights.

ARCAD-3 is an extension of a French-Soviet cooperative research program initiated in 1971 and 1973, when OREOL-1 and OREOL-2 were launched to explore physical phenomena in the upper layers of the earth's atmosphere. The analysis of data obtained through these space experiments is still continuing at the computer centers of the USSR Academy of Sciences' Space Research Institute and France's National Space Research Center (CNES).
[198-P]

CSO: 1866

'INTERSPUTNIK' COUNCIL MEETS IN BAKU

Baku BAKINSKIY RABOCHIY in Russian 15 Dec 79 p 2

[Excerpt] The eight session of the "Intersputnik" council has ended in Baku. Delegations of the 10 "Intersputnik" member countries--Bulgaria, Hungary, Vietnam, the GDR, Cuba, Mongolia, Poland, Romania, the USSR and Czechoslovakia--participated in the session's proceedings, which lasted five days. Also attending the session were a number of observers from various countries and international organizations.

At the request of an Azerinform correspondent, V. A. Shamshin, USSR first deputy minister of communications and chairman of the eighth session of the "Intersputnik" council, commented on the work of the session.

"The session examined the work of the organization for the year 1979," he said. "In this connection it was noted that Intersputnik has expanded its work on the international exchange of television programs and the maintenance of reliable telephone and telegraph communications.

"'Intersputnik' has now been in existence for eight years. Its membership is increasing. At the present session the Socialist Republic of Vietnam became a member of our organization. It was also decided to include a ground station of the Algerian Democratic People's Republic in the 'Intersputnik' communications system.

"A new ground station, the 'Moskva,' was demonstrated to participants during the session. By the way, we shall leave the station in Baku so that Azerbaydzhan communications specialists can use it for work in remote mountain areas where there are no capabilities at present for television reception." [160-P]

CSO: 1866

MOSCOW CONFERENCE ON REMOTE SENSING OF NATURAL RESOURCES

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA GEOGRAFICHESKAYA in Russian No 6, 1979 pp 154-155

[Article by A. I. Melua: "The Use of AES for Earth Resources Studies"]

[Summary] On 12-14 March 1979 Soviet specialists in the fields of cartography and geodesy participated in a conference commemorating the 60th anniversary of Lenin's decree "On establishing a Higher Geodetic Administration" and focusing, in part, on the use of satellites for the remote sensing of the earth's natural resources. According to L. I. Zlobin of the "Priroda" State scientific center, who chaired the session, one of the fundamental goals of the conference was the exchange of ideas, experiences and research results in the common search for "more effective paths for introducing space photography into practical use for the national economy."

Ye. L. Lukashevich and A. D. Koval' of the "Priroda" center discussed in their presentation to the development of earth surveying from space, describing the photographic work conducted on board various Soviet manned space vehicles (Vostok, Voskhod, Soyuz and Salyut). In formulating some possible directions for future space survey operations, they noted the necessity of increasing the speed of processing space data, widening the circle of consumers, continuing the development of multispectral and IR survey apparatus, and equipping orbital stations with devices to aid visual observations of the earth's surface. In this vein, they noted that a serious problem to be dealt with is that, to date, Soviet spacecraft do not fly in optimum orbits for space survey operations:

> "A serious obstacle to the development of space surveying... is that not one of the existing space vehicles has an orbit optimal for survey operations; it obviously follows, therefore to develop a specialized orbital station or module with greater survey capabilities."

The question of automating aerospace videoinformation processing was addressed by two lecturers, including N. V. Sazonov of the "Priroda" center, who cited the experience of "Priroda" as testimony to the fact that the future lies in the creation of high-speed digital computer complexes, and A. A. Chigirev, who described the "Format" space photo processing complex, which has been tested at the Aerospace Methods Laboratory of the USSR Ministry of Geology.

A number of reports were devoted to the use of space photography for detecting and mapping land-forms, mineral and water resources, forest reserves, crops, etc.:

a.) Yu. G. Kel'ner, Ye. P. Arzhanov, L. I. Zlobin, and L. K. Zatonskiy, in their talk on the present and future of using space information in cartography, indicated that because 2/3 of the users of space data are interested in obtaining maps based on space photographs, it is necessary to refine cartographic methods of analysis and to increase the effectiveness of their use by consumers. In this connection, they emphasized the need for qualified specialists in the field of space information processing.

b.) B. V. Krasnopevtseva, who represented a group of authors from MIIGAiK, reported on the comprehensive processing of space survey materials obtained on Salyut orbital stations and their impact on regional mapping.

c.) V. A. Busha and G. V. Makhin and A. A. Aksenov and A. N. Shardanov of "Aerogeologiya" reported on the use of space photos in mapping geological forms, which is instrumental in revealing mineral and oil and gas resources.

d.) The importance of space survey materials for land-use planning and urban development was stressed by A. A. Lyutiy (IGAN SSSR) and by V. I. Smirnov and A. I. Melua (LenNIIPgradostroitel'stva), who also reported on the establishment of a data bank at LenNIIPgradostroitel'stva to hold the results of the analysis of space photographs.

e.) Other reports addressed the use of space photography in forestry (V. I. Sukhikh, Lesproyekt), agriculture (G. S. Yelesin and V. A. Kalnina, State Institute of Earth Resources), and land reclamation and water conservation (Ye. A. Panadiadi, VNII Hydrotechnology and Land Reclamation).

V. N. Kravtsova discussed the results of the "Raduga" multispectral experiment and noted as well as the information value of the MKF-6 photographs.

Several reports centered on lunar and planetary cartographic investigations:

a.) Yu. S. Tyuflin of TsNIIGAiK, on mapping the moon and the planets;

b.) V. V. Usova of MIIGAiK, on thematic mapping of the moon based on "Zond-3" survey data.
[142-P]

CSO: 1866

VIII. Launch Table (All data is provided by the Soviet news agency TASS)

Date	Designation	Orbital Parameters				Notes
		Apogee	Perigee	Period	Inclination	
9 Jan 80	Cosmos-1149	414 km	208 km	90.4 min	72.9°	
11 Jan 80	Molniya-1	40,830 km	478 km	12 h 17 min	62.8°	Communications satellite; for long-distance telephone and telegraph communications and TV broadcasting within the "Orbita" network
14 Jan 80	Cosmos-1150	1028 km	998 km	105 min	83°	
23 Jan 80	Cosmos-1151	678 km	650 km	97.8 min	82.5°	"Information is transmitted to the institutes of the USSR Academy of Sciences for processing and utilization."
24 Jan 80	Cosmos-1152	370 km	181 km	89.7 min	67.1°	
26 Jan 80	Cosmos-1153	1,031 km	983 km	105 min	83°	
30 Jan 80	Cosmos-1154	671 km	634 km	97.3 min	81.3°	
7 Feb 80	Cosmos-1155	422 km	206 km	90.4 min	72.9°	
12 Feb 80	Cosmos-1156 -- Cosmos-1163	1,52[illegible] km	1,450 km	115.4 min	74°	
13 Feb 80	Cosmos-1164	640 km	220 km	92.9 min	62.8°	

END OF FICHE DATE FILMED

11 March 80

DD